Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

High-fidelity single-shot Toffoli gate via quantum control[1] BARRY SANDERS[2], EHSAN ZAHEDINEJAD, JOYDIP GHOSH, University of Calgary — A single-shot Toffoli, or controlled-controlled-NOT, gate is desirable for classical and for quantum information processing. The Toffoli gate alone is universal for reversible computing and, accompanied by the Hadamard gate, are universal for quantum computing. The Toffoli gate is a key ingredient for (non-topological) quantum error correction. Currently Toffoli gates are achieved by decomposing into sequentially implemented single- and two-qubit gates, which requires much longer times and yields lower overall fidelities compared to a single-shot implementation. We develop a quantum-control procedure to directly construct single-shot Toffoli gates and devise a scheme for three nearest-neighbor-coupled superconducting transmon systems that should operate with 99.9% fidelity under realistic conditions. The gate is achieved by a non-greedy quantum control procedure using our enhanced version of the Differential Evolution algorithm. arXiv:1501.04676

[1]Acknowledges support from AITF, NSERC, USARO and 1000 Talent Plan
[2]Other affiliations: University of Science and Technology of China, Hefei, and Canadian Institute for Advanced Research, Toronto

Barry Sanders
University of Calgary

Date submitted: 24 Jan 2015 Electronic form version 1.4